ABSTRACT

Using Historical Precipitation, Temperature, and Runoff Observations to Evaluate Evaporation Formulations in Land Surface Models

Authors: Randal D. Koster and Sarith P. P. Mahanama
NASA, Goddard Space Flight Center
Global Modeling and Assimilation Office
Greenbelt, Md. 20771

Key to translating soil moisture memory into subseasonal precipitation and air temperature forecast skill is a realistic treatment of evaporation in the forecast system used – in particular, a realistic treatment of how evaporation responds to variations in soil moisture. The inherent soil moisture-evaporation relationships used in today's land surface models (LSMs), however, arguably reflect little more than guesswork given the lack of evaporation and soil moisture data at the spatial scales represented by regional and global models. Here we present a new approach for evaluating this critical aspect of LSMs. Seasonally averaged precipitation is used as a proxy for seasonally-averaged soil moisture, and seasonally-averaged air temperature is used as a proxy for seasonally-averaged evaporation (e.g., more evaporative cooling leads to cooler temperatures); the relationship between historical precipitation and temperature measurements accordingly mimics in certain important ways nature's relationship between soil moisture and evaporation. Additional information on the relationship is gleaned from joint analysis of precipitation and streamflow measurements. An experimental framework that utilizes these ideas to guide the development of an improved soil moisture-evaporation relationship is described and demonstrated.